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(54) Abstract Title

Concurrent recording and playback of broadcast material

(57) An apparatus and method for recording broadcast material wherein a buffer signal store is used to concurrently store received broadcast material and display the stored material after a user defined time delay. A user-operable control allows adjustment of the time delay imposed by the buffer signal store. As described, a set-top box 100 receives broadcast material from sources such as satellite, terrestrial or cable or material broadcast via the Internet. This material is recorded using a recording/replay device such as video storage device 70, or a random access memory device, at the request of the user e.g. via remote control 110 (also see fig.14) or automatically in response to a viewing interruption such as an incoming telephone call at telephone 50 or the doorbell monitor 95 indicating the doorbell ringing and the door being answered. Replay is then re-initiated manually by the user when the interruption has ended. The buffer continues to store received broadcast material in concurrence with the user viewing its contents.

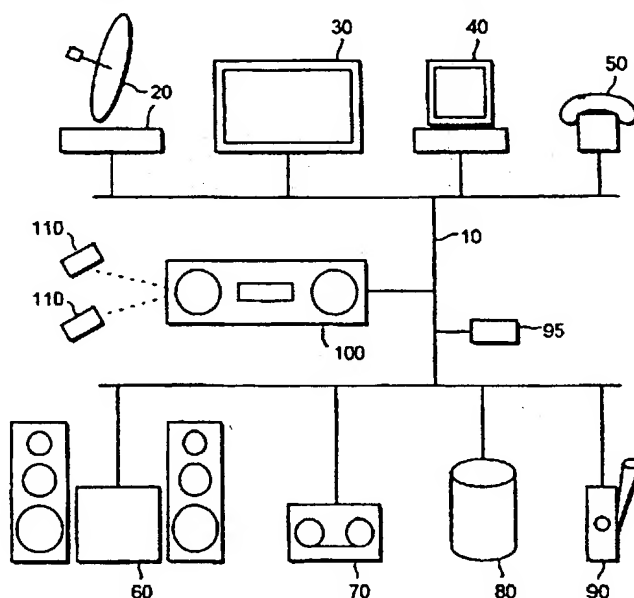


FIG. 1

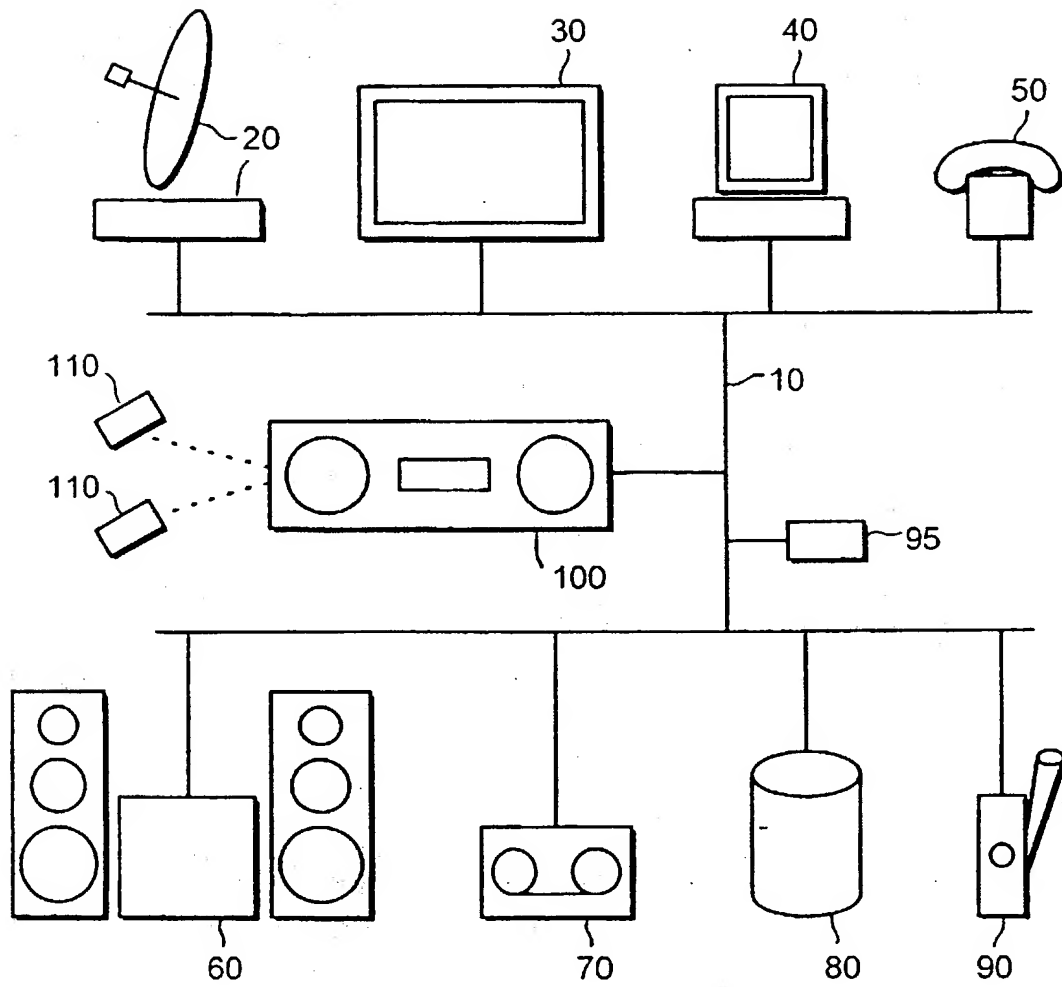


FIG. 1

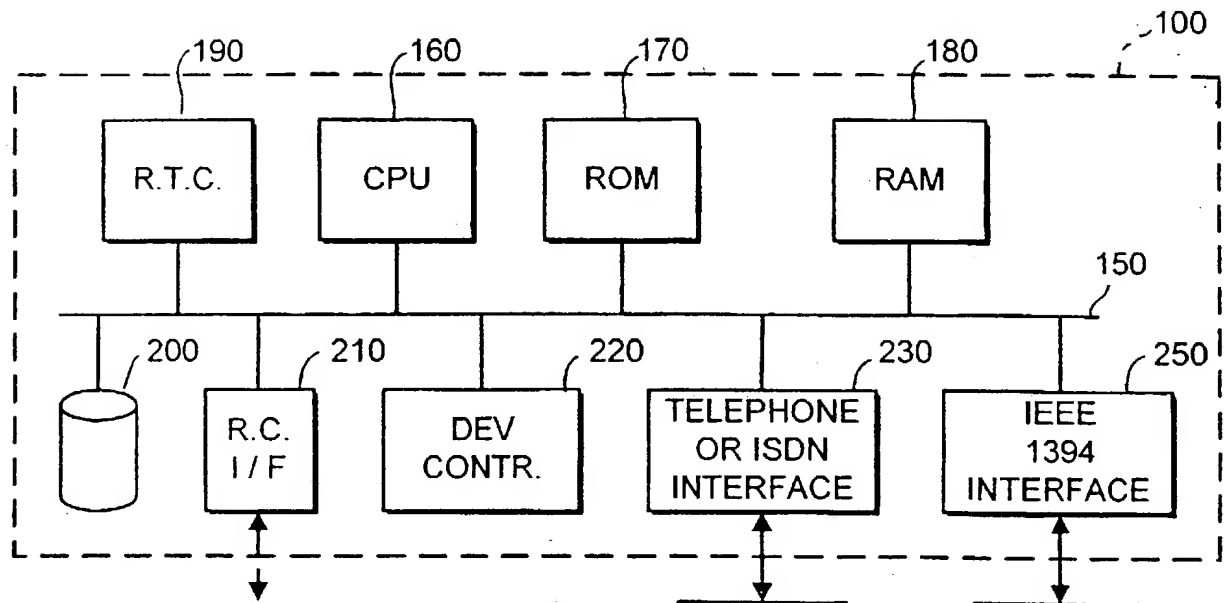


FIG. 2

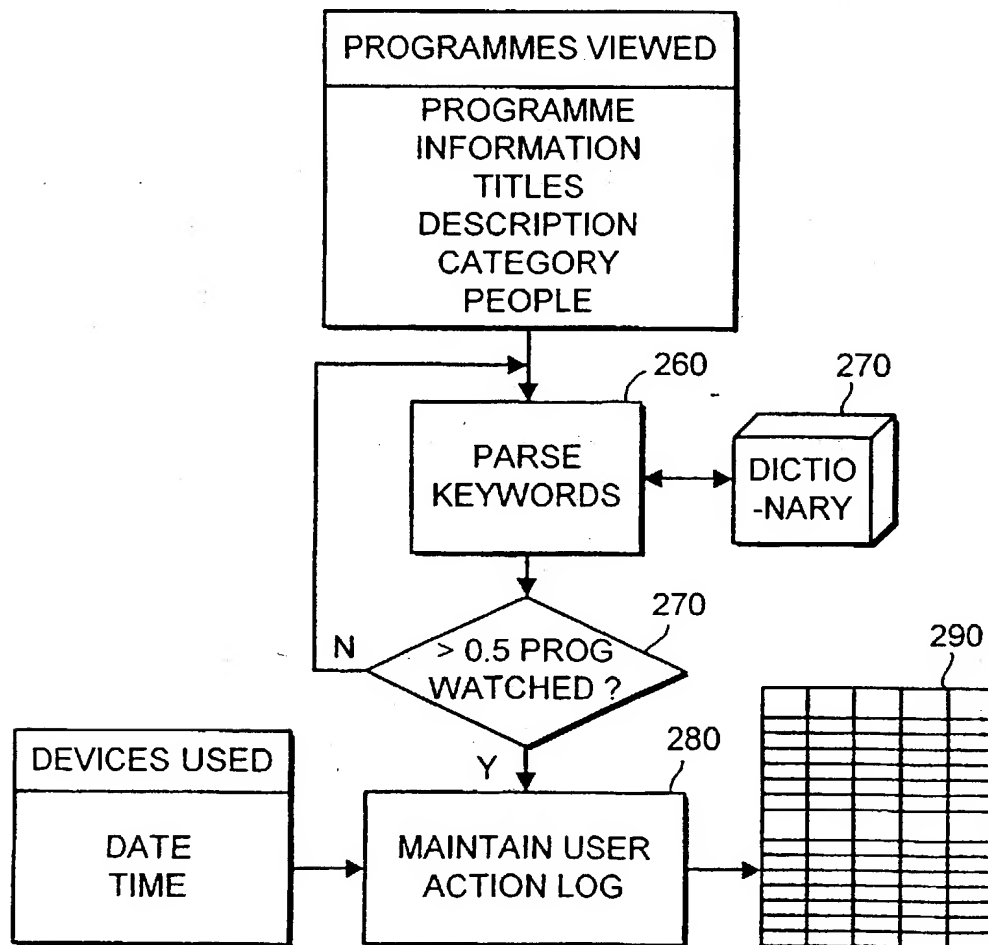


FIG. 3

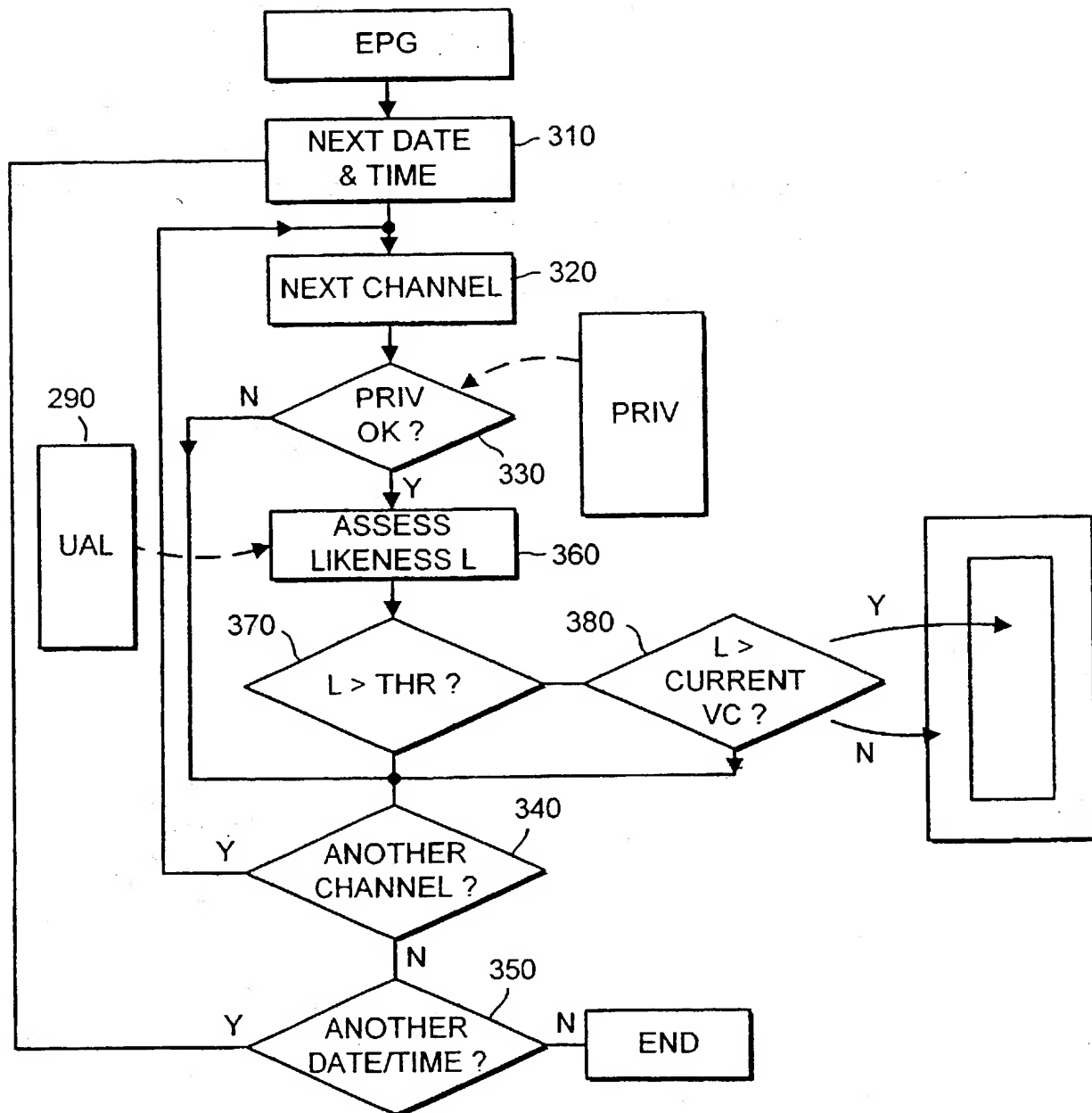


FIG. 4

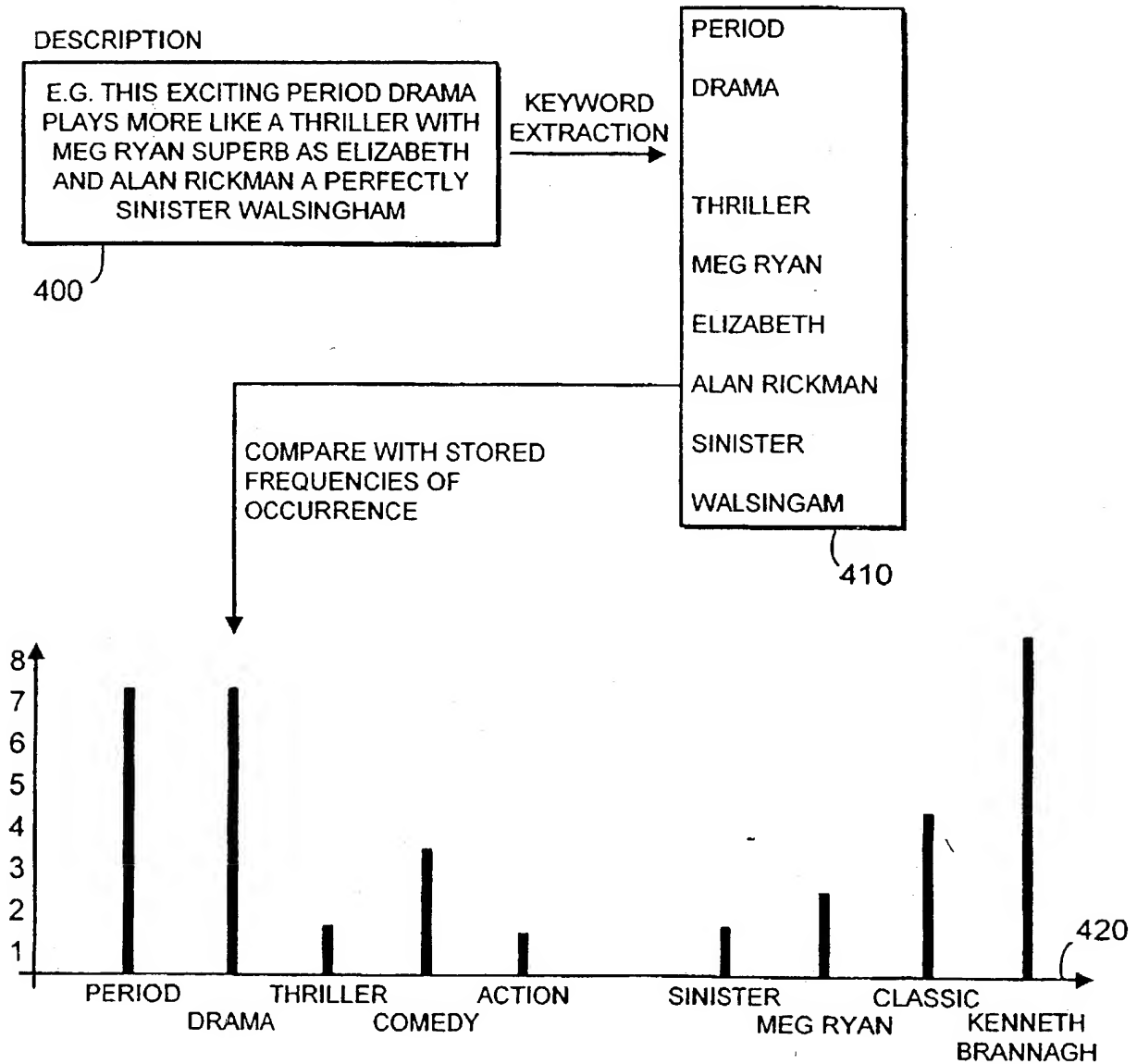


FIG. 5

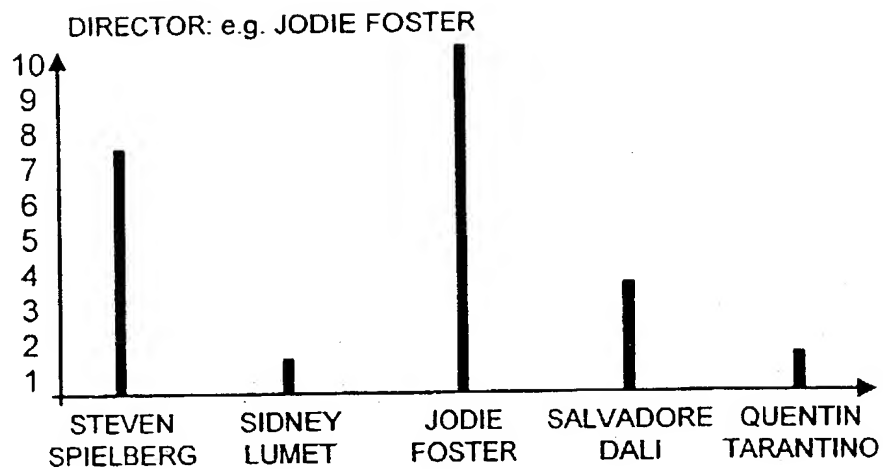


FIG. 6

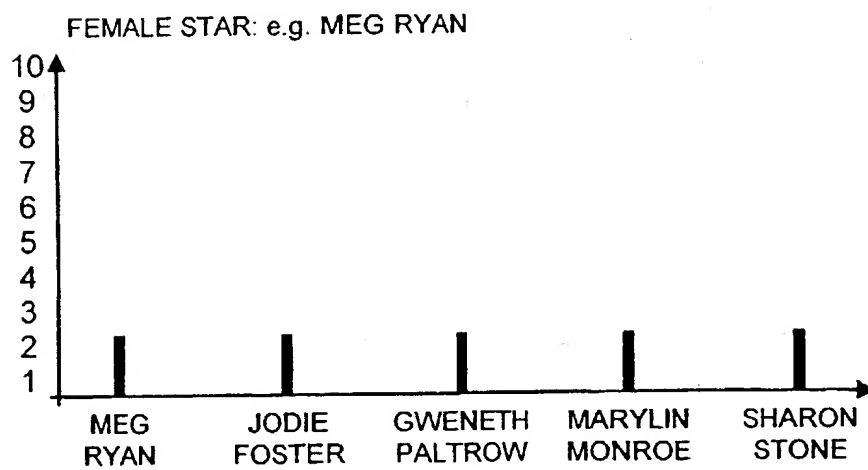


FIG. 7

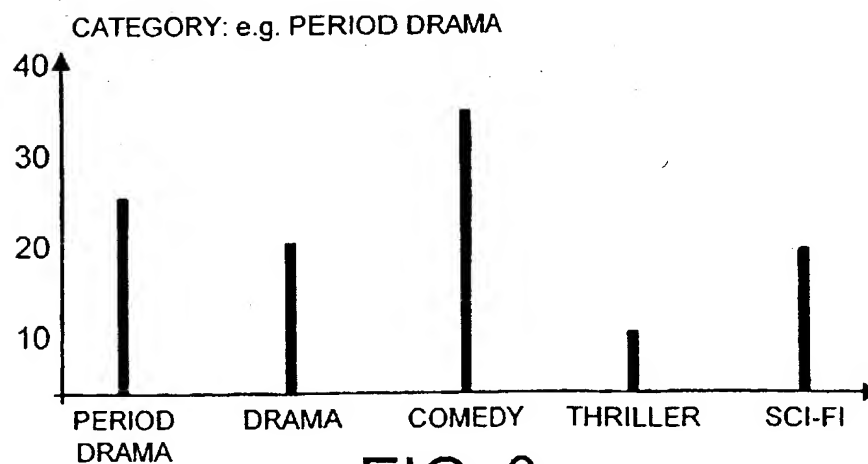


FIG. 8

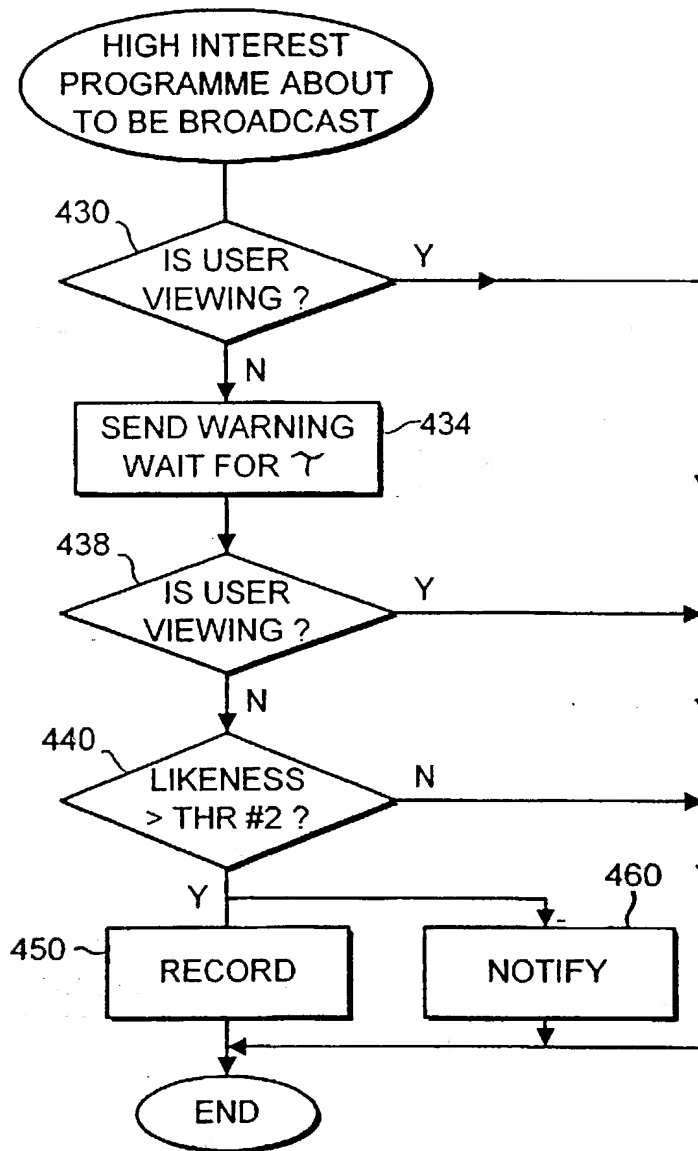


FIG. 9

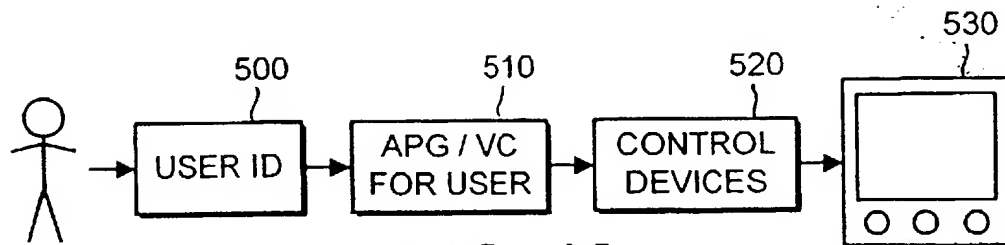


FIG. 10

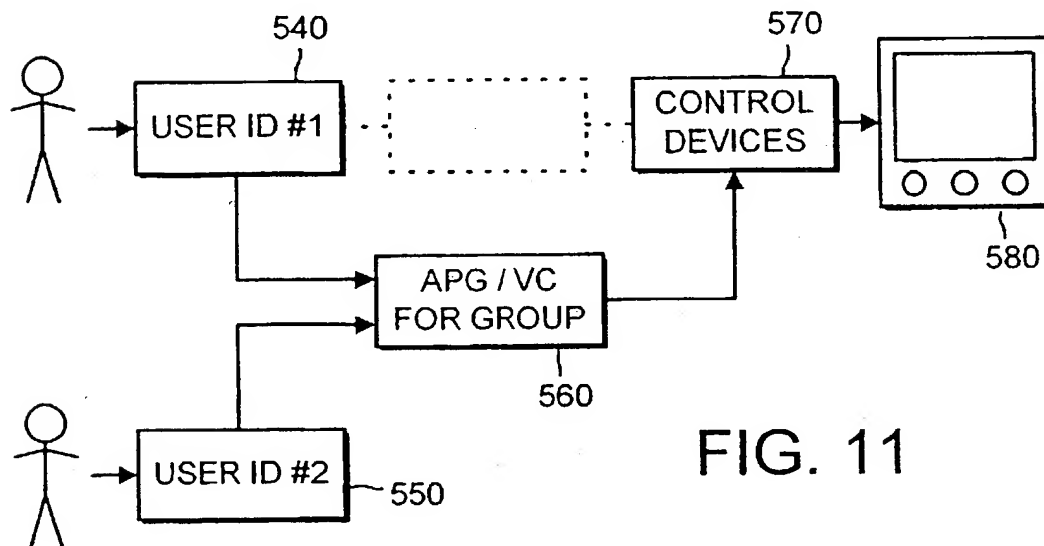


FIG. 11

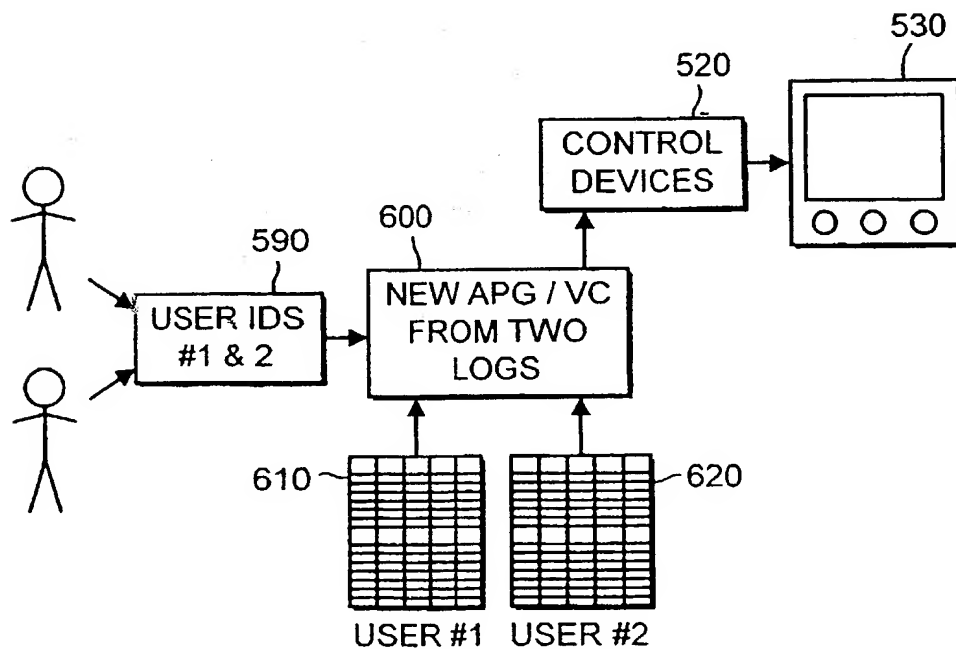


FIG. 12

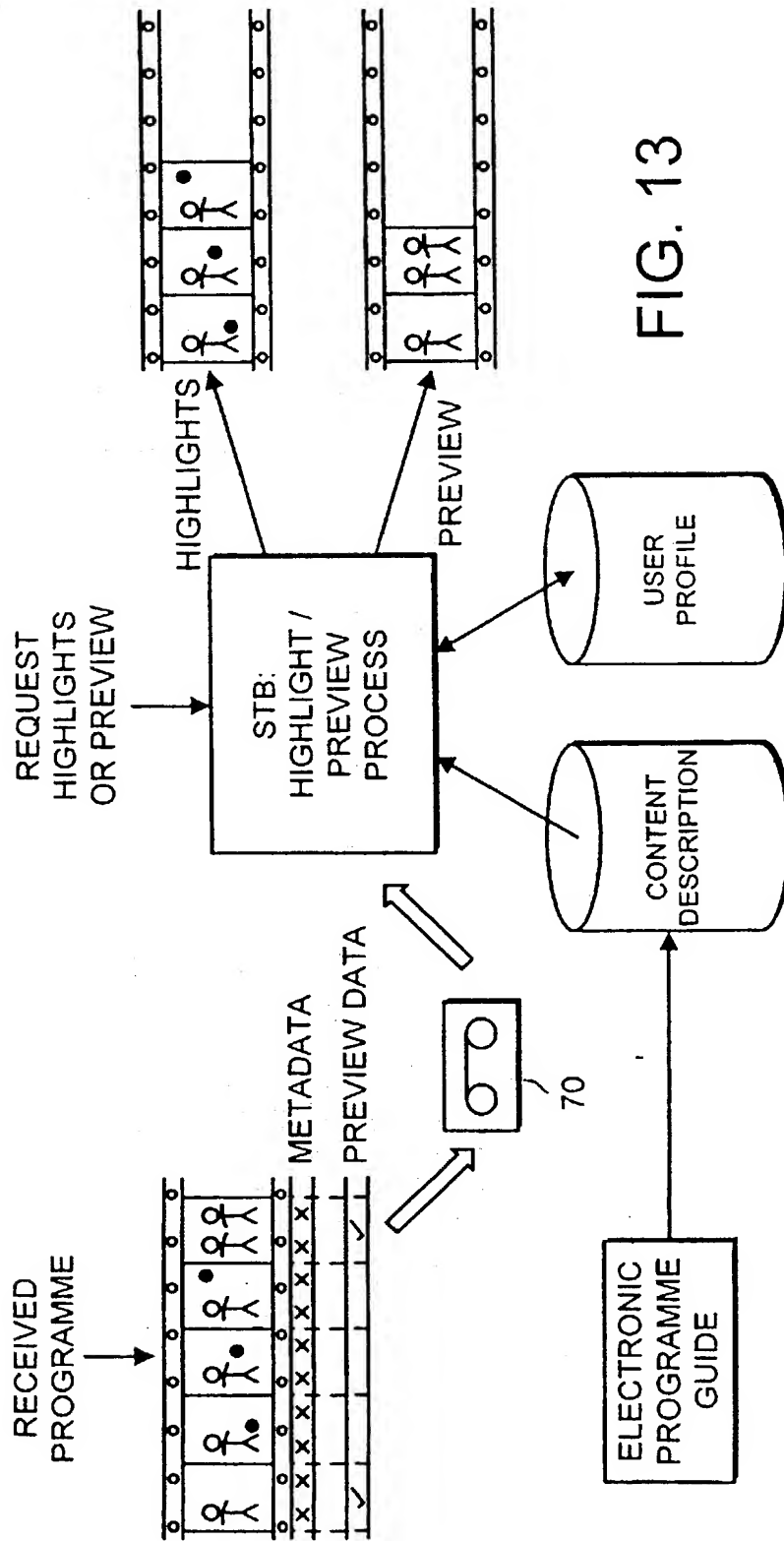


FIG. 13

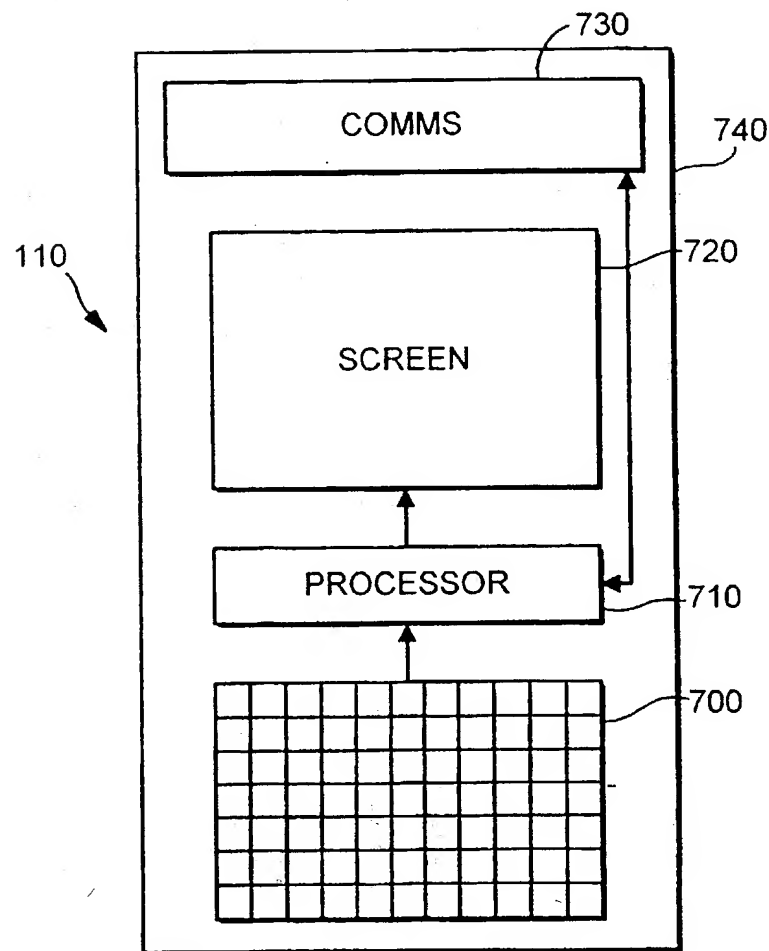
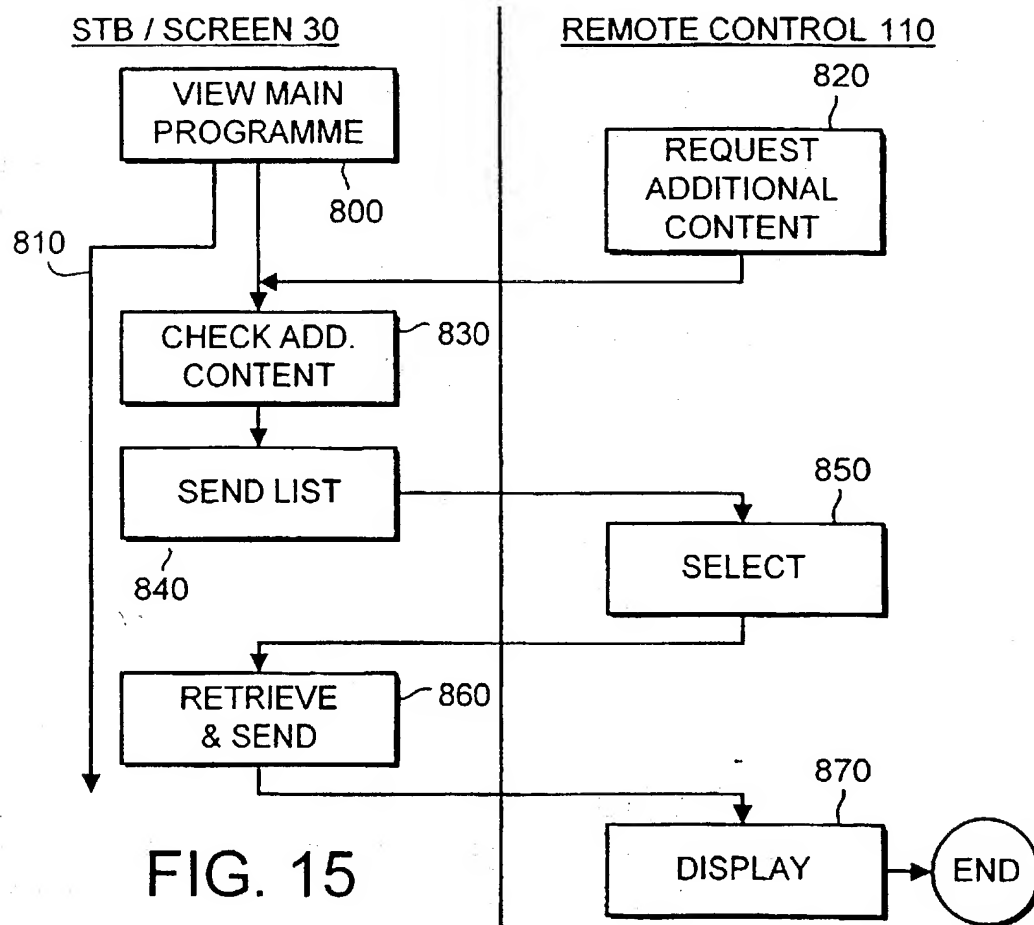


FIG. 14



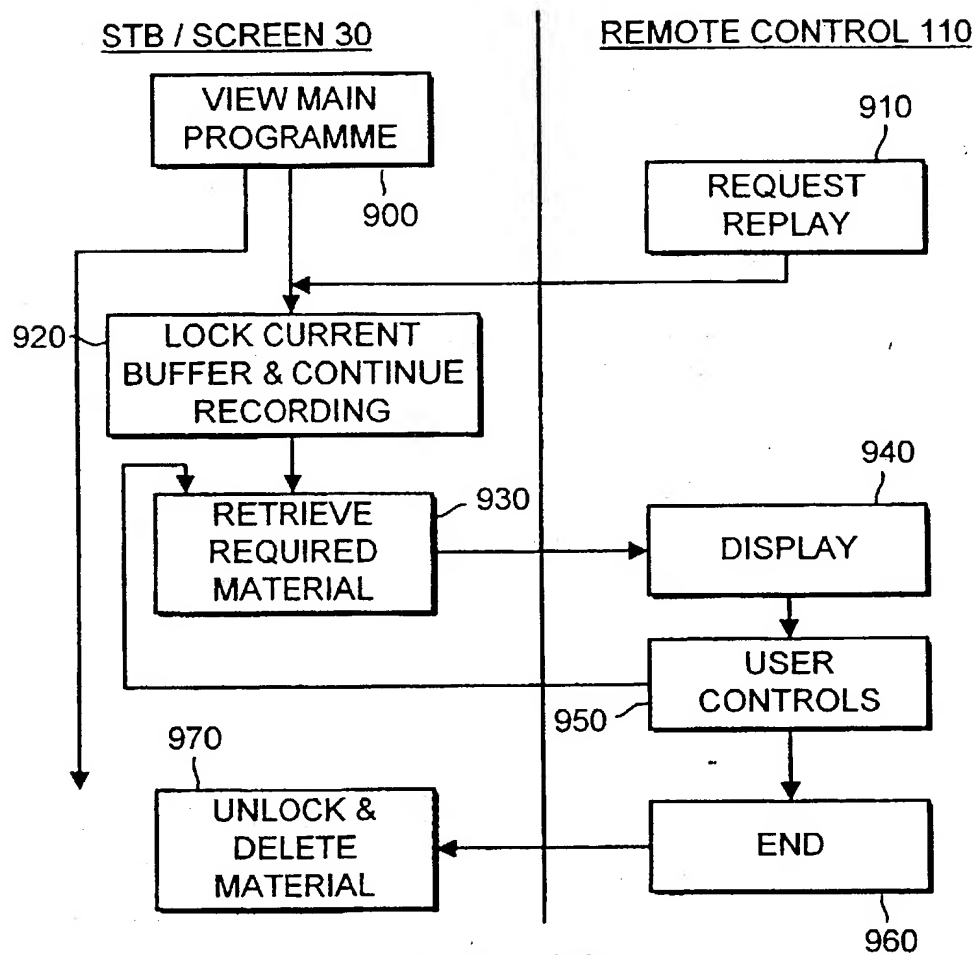


FIG. 16

RECORDING BROADCAST MATERIAL

This invention concerns apparatus and methods for recording broadcast material.

5 The advent of digital television and interactive networks mean that a wide variety of entertainment choices will be open to the home entertainment consumer. This will include a vast number of channels, some of which will be free, some will be paid by regular subscription and others which will be so-called "pay per view" channels. The consumer will be able to access information about these channels
10 through electronic programme guides, possibly also receiving further related information concerning the main actors, the main plot lines or the director.

Consumer equipment for receiving home entertainment is also likely to become more complex. The number of television sets and other home entertainment hardware per household is likely to further increase, while systems become increasingly capable
15 of handling more than one type of storage medium. The home entertainment consumer of the future might therefore have a compact disc (CD) collection, a digital versatile disc (DVD) collection, a laser disc collection and a videotape collection, which may be played and (where appropriate) recorded on by a variety of devices.

The plurality of channels and devices will increase the potential for conflicts in
20 home entertainment. For example the user may wish to watch two programmes which overlap by only five minutes such that recording one of them is irksome. Alternatively the user may wish to answer the telephone or the front doorbell without substantially interrupting his viewing.

There is also the potential for conflicts between users, made more likely by the
25 plurality of channel choice. A husband and wife may, for example want to watch two different programmes which slightly overlap in same time.

This invention provides apparatus for recording broadcast material, the apparatus comprising: a buffer signal store for concurrently storing received broadcast material and replaying the received broadcast material for display, so as to impose a

time delay between reception and display of the received material; and a user-operable control for adjusting the time delay imposed by the buffer signal store.

In the invention, a user-operable buffer store is provided so that at the start of an interruption to viewing, or for the overlap period between two programmes, a received programme is recorded and replayed a short time later, concurrently with continued recording of the programme. This therefore places a user-operable delay in the signal chain. The operation by the user can be completely manual or could be semi-automatic, in that the operation is initiated by a user request to watch two overlapping programmes. Similarly, the operation could be initiated by automatic detection of a viewing interruption, such as an incoming telephone call, with replay being re-initiated manually by the user.

Accordingly, the elegantly simple approach of placing a user-operable and adjustable delay in the signal chain allows the user much flexibility in handling viewing conflicts or programme interruptions.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic diagram of a home entertainment system;

Figure 2 is a schematic diagram of a set-top-box;

Figure 3 is a flow chart illustrating the formation of a user action log;

Figure 4 is a flow chart illustrating the formation of an adaptive programme guide;

Figure 5 schematically illustrates the parsing of electronic programme guide data for inclusion in the user action log;

Figures 6 to 8 schematically illustrate a distribution of data stored in the user action log;

Figure 9 is a flowchart illustrating a recording operation;

Figure 10 is a schematic diagram illustrating user privileges when a single user is operating the system of Figure 1;

Figures 11 and 12 illustrate user privileges when two or more users are operating the system of Figure 1;

Figure 13 schematically illustrates the derivation of highlight and/or preview programme clips;

Figure 14 schematically illustrates a remote control device;

Figure 15 is a flow chart illustrating the display of related material on the
5 remote control device; and

Figure 16 is a flow chart illustrating the display of replay material on the remote control device.

Figure 1 is a schematic diagram of a home entertainment system comprising a number of system components linked by an IEEE1394 network 10. The components
10 include a satellite dish and receiver 20, a television 30, a computer such as a Personal Computer (PC) 40, telephone apparatus 50, an audio receiver, recorder and playback device 60, a video storage device 70, a data storage device 80, a digital camera 90, a doorbell monitor 95 and a set top box (STB) 100. Remote control units 110 are arranged to interact with the STB 100.

15 In the embodiment of Figure 1, the STB is arranged as a master device to have operational control over the other devices attached to the IEEE1394 network 10. So, for example, the STB 100 may control the television screen 30 to display pictures received by the satellite receiver 20 while the video storage device 70 records pictures captured by the digital camera 90, and so on. The routing of multimedia data between
20 the different devices takes place under the protocols established by the IEEE1394 standard.

The doorbell monitor is arranged to monitor not only when the user's doorbell rings, but also whether the house door is then opened. The use for this feature will be described further below.

25 Figure 2 schematically illustrates the set top box 100. Internally, the set top box comprises a number of components connected to an internal data and address bus arrangement 150. These components include a central processing unit (CPU) 160, read only memory (ROM) 170, random access memory (RAM) 180, a real time clock (RTC) 190, data storage such as a disc drive 200, a remote control interface 210 for
30 interfacing to the remote controls 110, a device controller 220 having device drivers

for the various devices attached to the IEEE1394 network, a telephone and/or ISDN interface 230 for connecting to a telephone and/or ISDN line 240, and an IEEE1394 interface 250 for connecting to the IEEE1394 bus 10.

The operations of the STB to be described below take place by suitable data and signal processing programmes stored in the ROM 170, the storage device 200 and/or the RAM 180 being run by the CPU 160.

Figure 3 is a schematic diagram illustrating the formation of a user action log by the STB.

The description of Figure 3 takes the example of television programmes, but it is equally applicable to audio (radio) programmes or any other broadcast material possibly including terrestrial broadcast, satellite broadcast, cable transmissions, material broadcast via the internet and so on. In fact, in this description, "broadcast" material refers to material for which the user has little or no control over the arrival time of the material.

Referring to Figure 3, for each programme viewed by the user, the STB accesses data relating to that programme from an electronic programme guide (EPG). EPGs are becoming widely available either as part of the bit stream providing the actual broadcast material or as separate digital information from an external EPG vendor, for example being accessed via the internet or a dial-up modem connection. An example of part of the information contained in an EPG is as follows:

Channel	17:00	17:30	18:00	18:30
BBC1	Blue Peter	Neighbours	National News	Regional News
BBC2	Red Dwarf	Does he take sugar	The Simpsons	The Simpsons
ITV Carlton	Hollyoaks	Home and Away	London Tonight	Sizzled
ITV Meridian	Hollyoaks	Home and Away	Meridian Tonight	Sizzled

C4	The Cosby Show	The Cosby Show	The Munsters	The Munsters
C5	Family Affairs	Family Affairs	FILM: Hercules	FILM: Hercules
FOX	The Racoons	The Racoons	Genuine Risk	Genuine Risk
CBS	Up to the Minute	Up to the Minute	CBS News	CBS News
...
CNN	Evening Edition	Evening Edition	Evening Edition	Evening Edition
ABC	It happens every ...	Thursday	It happens every ...	Thursday
Sky 1	Star Trek: DS9	Star Trek: DS9	Xena	Xena
Discovery	Mother Nature	Acorn: The Nature	Nut	Jungle Cubs
TNT	CHiPs	CHiPs	Starsky & Hutch	Starsky & Hutch
Nickelodeon	You're on Nick,	Charlie Brown	You're on Nick,	Charlie Brown
Encore	Just one of the Guys	Just one of the Guys	Just one of the Guys	Just one of the Guys
HBO	Nothing in Common	Nothing in Common	Nothing in Common	Nothing in Common

In addition, the EPG provides, for each listed programme, information such as the programme title, a brief description, a programme category, for example selected from a standard category list and the people concerned in the making of the programme, such as actors, directors and so on are listed. If any one of these items is missing from the particular EPG entry relating to a current programme, this is not a

problem for the operations to be described as that item can simply be ignored in the following description.

An example of a part of such a standard category list is as follows. The categories are arranged in a hierarchical structure, with a small number of fundamental
 5 categories, each broken down into sub-categories and so on. As the whole list would extend over many pages only a few of the categories are listed here.

10	Advertising:	Teleshopping	
		Public service announcements	
15	Animation:	Cartoon	
		Feature length cartoon	
		Plasticine	
		Puppets	
20	Culture:	Documentary	
		Documentary:	Architecture
			Cinema
			Fashion
			Jazz
		Event	
25		Event:	Classical music
			Jazz
			Literature
			Theatre
	Discussion		
30	Discussion:	Debate	
		Debate:	Consumers / Everyday Life
			Politics

and so on.

An alternative standard for programme categorisation has been proposed by the DVB consortium.

At a step 260, so-called key words are parsed from the programme information
5 provided by the EPG. The parsing operation is carried out with the assistance of an
electronic dictionary 270 such as the so-called Wordnet dictionary distributed by
Princeton University and available at the priority date of this application on the
internet at <http://www.cogsci.princeton.edu/~wn/>

The Wordnet programme and associated dictionary is capable of establishing
10 which words within the programme description are nouns. These words can then be
passed to subsequent steps for addition to the user action log.

The step 260 also involves a further search for actors' names by comparison
with a database of actors' names stored in the dictionary 270. Again at the priority
date of this application, a list of over 6000 television and film actors' and actresses'
15 names can be found on the internet at:
http://dir.yahoo.com/Entertainment/Actors_and_Actresses/

At a step 270 a test is formed as to whether the user watched at least half of the
current programme. This test is carried out by establishing the start and stop times of
the user's viewing (with the aid of the real time clock 190) and comparing these to the
20 duration of the programme as specified in the received EPG. If less than half of the
programme was viewed, details of that programme are not-added to the user action log
and control returns to the step 260 to be repeated for the next-viewed programme.
However, if at least half of the programme has been viewed, control passes to a step
280 where an entry is made relating to the current viewing activity in the user action
25 log 290.

The user action log 290 is effectively a list of actions and associated
frequencies of occurrence, maintained over a predetermined number of actions such as
the most recent 1000 actions.

Each action relates to a particular viewing operation. When an action (i.e.
30 viewing the current programme) is added to the user action log, the frequency of

occurrence for each of the key words identified in the step 260 is incremented. (If a key word is not present in the log at all, that key word is added with an initial frequency of occurrence of 1.) Also, the frequency of occurrence is incremented for data relating to the particular period of viewing the channel carrying the current programme. So, for example, if the user has viewed a programme on channel x between 7pm and 7.30pm on a Tuesday using a television set located in the user's kitchen, the occurrence frequencies for the following entry in the user action log is incremented:

Tuesday, 7-7.30, channel x, kitchen TV

In this way, over the course of time, a user action log is built up giving a history of that user's viewing habits and preferences. Parts of the user action log will be shown graphically below, but the user action log can also be considered as a table of events and associated frequencies of occurrence. A schematic example is shown below:

Event Type	Details	Number of Occurrences
Programme category	News	37
	Animation: puppets	11
	Entertainment: soap opera	259
	Discussion: debate: politics	2

Programme Director	Sydney Lumet	13
	Stephen Spielberg	6
	Grant / Naylor	3

Viewing time	TV: 19:00 - 19:30	135
	TV: 08:00 - 08:20	22
	TV: 13:35 - 14:00	126

Although the information shown above appears to relate to one user or to a collective analysis of whoever is using the equipment at any time, this is just for clarity of the above description. In fact, a user action log is maintained for each individual user and, in some embodiments, for each permutation of groups of users of the system. 5 Separate logs can also be maintained for different periods in the week, e.g. weekends and weekdays.

In order to do this, the system has to detect who is currently using the system at any time. In the preferred embodiments, this is carried out as follows. Each user has 10 an associated personal remote control device 110. When the user starts to use the system, for example to watch or listen to a programme, the user "logs in" to the system by pressing a button on that user's remote control device 110. This causes a message to be transmitted from that remote control device to the STB, identifying that user and indicating that the user has started using the system. When the user is ready to finish 15 using the system, the user again presses an appropriate button on his remote control sending a corresponding "log out" message to the STB. In this way, the STB maintains a record of all currently logged-in users, and so adds a new entry relating to a currently viewed programme to the user action log appropriate to either the current individual user or to the group of currently viewing users.

20 Figure 4 is a schematic diagram illustrating the process by which the STB derives an "adaptive programme guide" and a "virtual channel" of proposed viewing for the currently logged-in user(s). In the embodiments to be described these are derived from the user action logs, but in other embodiments where a "learning" system is not employed to generate the user action logs, a user could input manually a series of 25 criteria for use in deriving the virtual channel and adaptive programme guide. These criteria would be stored in a file and used in the same way as the user action log in the description below.

One of the disadvantages of broadcast systems providing very many broadcast channels is the complexity of the programme guides. With analogue terrestrial 30 television and radio, the user had only to consult programme listings for perhaps four

or five channels. This could easily be done using a printed programme guide. With systems currently being implemented (including analogue cable and satellite systems as well as the newer digital broadcast systems) the number of channels available is huge, possibly 200 or more, and so even with an on-screen EPG the user could be
 5 faced with searching for a long time before being able to select the best viewing schedule for an evening's television.

This disadvantage is addressed by the present embodiments, in that a virtual channel and an adaptive programme guide are generated for display to the user.

The *virtual channel* is a concatenation of broadcast items from various different
 10 (real) broadcast channels, put together to form a contiguous or near-contiguous viewing session (e.g. an evening's viewing). The programmes included in the virtual channel are selected by the STB to be those which have the highest objective likeness to the viewer's previous viewing habits and preferences. As an example, a virtual channel comprises a successive list of programme titles and respective channel
 15 numbers as follows:

Time Period	Channel	Programme Title
17:00 - 17:30	BBC 2	Red Dwarf
17:30 - 18:00	BBC 1	Neighbours
18:00 - 18:30	CNN	Evening Edition
...

To watch the virtual channel, the user simply accepts the recommendations made by the STB. The STB maintains the consecutive list in memory as shown above,
 20 and, by reference to the real time clock and/or programme delivery control (PDC) information transmitted along with the broadcast programmes, switches between channels at the appropriate times.

The *adaptive program guide* is a similar list of broadcast items of at least a predetermined level of interest assessed objectively by the STB using the viewing
 25 habits and preferences stored in the user action log. So, the virtual channel provides

those broadcast programmes having the highest objectively determined likeness to the viewing habits and preferences stored in the user action log, so that the virtual channel proposes only one programme at any one time. In contrast, the adaptive programme guide can have any number of programmes for a single time slot, subject to those programmes having at least a minimum likeness. The adaptive programme guide therefore removes programmes assessed not to be of interest from the list presented to the user. Because the adaptive programme guide includes programmes other than the most likely selection, it is effectively a superset of the virtual channel, including all of the programmes of the virtual channel and possibly many more. The user can select programmes from the adaptive programme guide to watch instead of those proposed in the virtual channel, for example by editing the virtual channel to replace a programme originally selected by the STB for inclusion in the virtual channel with another programme from the adaptive programme guide.

So, Figure 4 schematically illustrates the selection made by the STB of those programmes to be included in the virtual channel and the adaptive programme guide. The selection can be made at any time after the EPG information has been received for a particular day, though in the present embodiment the time at which the STB executes the steps of Figure 4 and selects programmes for the virtual channel and the adaptive programme guide for a particular day is at 11pm the evening before that day.

The process shown in Figure 4 refers to three main inputs: the EPG, the user action log 290 and a table of user privileges 300. User privileges, and particularly their use when groups of users are viewing, will be discussed below in more detail with reference to Figures 10 to 12. However, for the purposes of Figure 4, it is sufficient to consider that the user privileges define types of programmes which the users are or are not allowed to view, and are set by a system "superuser", such as a parent. So, for example, a young child might be barred by the system from watching any broadcast or pre-recorded programme having an adult content, expressed as an adult certification. The effect of this on the operation of Figure 4 is that programmes which do not comply with the user's privileges will not be included in the virtual channel or adaptive programme guide for that user.

At a step 310, the next date and time range to be considered is set. This might, for example, start at midnight and increment through the day in ten minute intervals. At a step 320 a next channel is selected, and the programme information for that time period and that channel examined. At a step 330 the selected programme is compared
 5 with user privilege data 300. If the programme does not comply with the user's privileges then control is passed to a step 340 where a test is carried out to detect whether all channels have been tested for the current date and time range. If this is not the case, control returns to step 320 where the channel is incremented.

If, at step 340, all available channels have been tested for the current date and
 10 time range, control passes to a step 350 where a test is carried out to detect whether all date and time ranges in the current period of interest (e.g. a day) have been tested. If so, then the whole process ends. If not, then control passes back to step 310 where the date and time range is incremented.

Returning to step 330, if the current programme does comply with the user's
 15 privileges, the "likeness" between that programme and the user action log for that user is assessed at a step 360. This assessment will be described in more detail below with reference to Figures 5 to 8, but in brief, a likeness value is generated having a higher value for better degrees of objectively assessed likeness between the user action log and the current programme.

At a step 370 the likeness value is compared with a threshold. If it is greater
 20 than the threshold then the programme is passed for inclusion in at least the adaptive programme guide, and possibly in the virtual channel. So, at a step 380 the likeness value for the current programme is compared with the likeness value for the programme currently in the virtual channel for that time period. If the current
 25 programme has the higher likeness value, it replaces the programme in the virtual channel which is in turn demoted to the adaptive programme guide. Otherwise, the current programme is placed directly in the adaptive programme guide. Control passes again to the step 340, as described above.

When the virtual channel and the adaptive program guide are displayed, the
 30 user might find that there is nothing of interest in the proposed selection. The user can

then adjust the threshold for inclusion of items in the adaptive programme guide, for example by operating a key on the remote control or by moving a screen icon such as a slider. Setting the threshold to zero is akin to switching off the adaptive programme guide function, as the whole electronic programme guide will be displayed.

- 5 Functionality and selection by the adaptive programme guide is maintained, however, for non-zero threshold values.

Figures 5 to 8 schematically illustrate the derivation of the likeness value described above.

- 10 In particular, Figure 5 schematically illustrates the programme information 400 from the EPG associated with a particular programme. The programme information includes a sentence describing the programme. This is parsed to form a list of keywords 410, primarily nouns, for example using the "Wordnet" program and list of personnel described above. The keywords are compared with frequencies of occurrence of those keywords previously stored in the user action log. Figures 6 to 8
15 illustrate the way in which this is done.

Figure 6 schematically illustrates a set of keywords under the grouping "Director". Figure 7 illustrates a set under the grouping "female star". Figure 8 illustrates a set under the grouping "category", i.e. a category from the long list of programme categories described above.

- 20 In more detail, as a programme is watched for at least half its length, details of the programme are stored in the user action log as described above, by incrementing the frequency of occurrence for each category, key word, date and time, title etc. In the same way, negative attributes can be stored for programmes which are contemporaneous with the watched programme and which are not watched. For
25 example, the user action log entry for a particular category etc. can be decreased by, say, 0.5, for a programme which is not watched while another programme is watched for at least 50% of the watched programme's length.

- The characteristics can be stored in the user action log as three ranks or orders. For the example of the attributes title, time, day and channel (i.e. leaving aside
30 keywords and personnel for the purposes of this table), these would be:

1st order: title, time, day of the week, channel

2nd order: (title & time), (title & day of the week), (title & channel)

5

3rd order: (title & time & day of the week), (title & time & channel),
(time & day of the week & channel)

In this way, the significance of various combinations of programme attributes
10 and viewing habits can be detected.

When the likeness value is to be assessed for a new programme, the match
between features of the new programme and the stored attributes in the user action log.
In particular, the attributes of the new programme are detected and arranged in the
three orders described above. These ordered characteristics are then considered as
15 characteristic values $C_0 \dots C_M$, where

$$C_i = \Sigma (\text{UAL values}) / \Sigma (\text{actions contributing to log for that characteristic})$$

where UAL signifies "user action log".

A recursive calculation can then be performed to determine the likeness value
for the new programme. The recursive calculation derives a value I by a series of
20 ordered steps, steps $i=0$ to $i=M$.

step 0	$I_0 = 0$
step 1	$I_1 = I_0 + (1-I_0)C_1$
...	...
step i+1	$I_{i+1} = I_i + (1-I_i)C_i$
...	...
step M	$I_M = I_{M-1} + (1-I_{M-1})C_{M-1}$

The derived value I_M is then considered to be the interest level or likeness value
for the newly considered programme.

In other embodiments, the likeness fit can be assessed not only from the frequency of occurrence associated with each keyword, but also from the (objectively assessed) importance which the user is deemed to have attached to that grouping of keywords. So, for example, because the grouping under "Director" is a highly peaked
 5 distribution, it is assumed by the STB logic that the user attaches a lot of importance to the choice of director and so the likeness value will be weighted more towards a good fit with the user's favourite directors. In contrast, the distribution shown in Figure 7 is fairly flat, which suggests that the user does not place great weight on the choice of female star in a programme. Accordingly the likeness value will be weighted so as to
 10 have little bearing on the choice of female star. It is noted here that one of the groupings used is the date, time and channel of the programme, so that if a user always watches at a particular time on a particular channel, that will be reflected in the calculation of likeness value of a programme at that time and channel.

A statistical test which detects the flat or peaked nature of a distribution is the
 15 so-called "entropy" test. A distribution having a low entropy is a relatively peaked distribution, and one having a high entropy is more flat. So, the likeness value is weighted generally inversely according to the entropy of each grouping of data.

In further embodiments, the user action log can be maintained in two temporal partitions, one for weekday viewing and one for weekend viewing. Here, the
 20 definition of weekday and weekend depends on local cultural and religious practices, but in the United Kingdom the weekend would generally be considered to be Saturday and Sunday, although these days could be altered by a user setting of the STB.

In other embodiments, the user can control the adaptive programme guide to display only those programmes in a certain broad category such as sport, news etc.
 25 This will lead to the display of programmes within that category but still having at least a certain objectively determined interest level for the user.

If the likeness value exceeds a second, higher, threshold then further action can be taken as illustrated schematically in Figure 9. In particular, the operations of Figure 9 ensure that even if a user is absent (not viewing), a programme having a very high

likeness to that user's established viewing habits and preferences will be automatically recorded for viewing later.

In Figure 9, a programme having a high interest level (a high likeness value) for a particular user is about to be broadcast. The programme is within the adaptive programme guide, but in order to trigger the process described below a further threshold value for the programme's likeness value could be applied.

A test is first performed at a step 430 to detect whether that user is currently viewing the system (i.e. is the user logged in?). If so, then the process (at least as regards that particular programme).

If the user is not present, then at a step 434 a warning is issued to the user. This could be for example a pre-recorded audio announcement being played over the loudspeakers 60, a visible warning on the television 30 or computer 40, a message paged using the telephone 50 and so on. The skilled man will appreciate that many different types of warning are possible with the collection of interconnected equipment of Figure 1.

After the warning has been issued the system pauses for a time τ to allow that user to log in to the system if he so desires. The time τ could be, for example, one minute. After the pause, a further test is performed at a step 438 to detect whether that user is viewing. If he is, then the process ends as regards that programme. (The user can be left to decide for himself what to view and/or record at that stage).

If the user is still not present at the step 438 then at a step 440 the likeness values of the programmes of the adaptive programme guide for the current time are compared with a second, higher, threshold. It is known that they all exceed a first threshold and comply with the user's privileges in order to have entered the adaptive programme guide, and it is known that the programme of interest which triggered the process is in the adaptive programme guide. The likeness values can preferably be stored with the programme details in the adaptive programme guide, or alternatively could be recalculated at this stage.

If the likeness value of a current programme in the adaptive programme guide exceeds the second threshold then it is recorded at a step 450 using the recording

device 70. An electronic mail message can also be sent to the user at a step 460 to inform him that the programme has been stored.

If more than one programme of the adaptive programme guide for the current time exceeds the second threshold, then this situation can be handled in various ways.

- 5 If there is the capacity to record only one programme at a time, then the programme with the highest likeness value will be recorded. Since this by definition will be from the virtual channel, the test at step 440 could just have referred to the likeness values for the virtual channel programmes. Alternatively, if there is capacity to store more than one programme, those having the highest likeness values are stored.

- 10 Figures 10 to 12 schematically illustrate the way in which the privileges and preferences for multiple users are combined. In particular, Figure 10 is a schematic diagram illustrating user privileges when a single user is operating the system of Figure 1, and Figures 11 and 12 illustrate different ways of handling group user privileges when two or more users are operating the system.

- 15 Referring to Figure 10, a single user logged in to the system has a user ID 500 which in turn is used to specify a virtual channel and adaptive programme guide 510. As a result of these the user controls 520 his viewing on a television screen 530.

- 20 When a second user logs in, as shown in Figure 11, the individual adaptive programme guides 510 are no longer relevant. Instead, a group adaptive programme guide and virtual channel 560, derived from a user log relating to viewing actions previously undertaken collectively *by that group* and the lowest common privileges associated with the group members is used to control 570 programmes shown on the television screen 580.

- 25 In an alternative arrangement, user IDs 590 control the creation of a group adaptive programme guide and virtual channel 600 form a sum or other combination of the user action logs 610, 620 associated individually with each of the two users. This in turn controls 630 programmes shown on the television screen 640.

In either of Figures 11 and 12, the privileges and preferences established when the first of the users logs in are modified when another user logs in.

Figure 13 schematically illustrates the derivation of highlight and/or preview programme clips as performed by the STB.

A received programme is stored on the video storage device 70. With the received programme so-called "metadata" (accompanying data) is provided by the programme initiator. The metadata can be stored with the programme on the video storage device 70 or separately on, say, the data storage device 80.

The metadata defines two things in relation to successive time periods (e.g. frames or small groups of frames) of the received video signal. Firstly, the metadata flags parts of the received programme which could be watched as a user preview in order to attract the user to watch the programme but without giving away the story. Secondly, the metadata identifies parts of the programme giving highlights - for example, goals being scored in the case of a football game or major story lines in the case of a soap opera. Indeed, the highlight information could be categorised, particularly in the case of sports events. For example, in the case of a motor race a first category could indicate major overtaking manoeuvres in the race, a second category indicates a major crash and so on, so that a user could select highlights according to his taste.

Accordingly, the user can request either a preview or a set of highlights for a stored programme. The programme is replayed along with the accompanying metadata. The STB detects and causes to be displayed those parts of the programme flagged by the metadata as containing highlight or preview material.

To speed the process, the STB can dump the highlight or preview material to an intermediate store so that it can be displayed substantially shamelessly to the user.

User preferences regarding highlight or preview material for different categories of programme can be stored as a user profile, these being compared with details derived from the EPG.

In a further embodiment, the apparatus can be arranged to record only highlight parts of a programme. This might be appropriate if a user is going to be away from home for some time but wishes to see the major developments over that period in, say, a favourite soap opera.

If the user is watching a series of programmes from the virtual channel (or a series otherwise selected) it may be that a gap occurs between desired programmes. The STB is operable to propose material to be displayed during this time gap.

On detecting a time gap in the virtual channel, the STB seeks material from other sources to fill the gap by trying to obtain material corresponding in some way to the material to be viewed either immediately before or immediately after the gap.

A first step in doing this is to establish a set of key words, as described above, for the programme to one side of the time gap. These key words are then used by the STB as search terms amongst (for example) the following material sources:

- 10 the internet
- stored video material, for example on the video storage device 70
- stored audio material
- image stored on the computer 40

and so on. These searches can be conducted in advance of the time of the gap. The STB then presents the user, via the television 30, with a selectable menu from which material to fill the gap (if any) can be selected.

Sometimes the converse can occur, in that the user is temporarily distracted from watching or listening to a programme and can miss a few minutes from within the programme. This can seriously affect viewer enjoyment.

20 In an attempt to alleviate this problem, the STB is operable to buffer the missed section using a multisession recording/replay device such as the video storage device 70 or a random access memory device.

The start of an interruption is detected in one of at least three ways: firstly, the telephone ringing and being answered; secondly the doorbell going and being answered; and thirdly by a simple user request via the user's remote control device.

25 In response to the start of an interruption, the current programme is stored to the multisession recording device. At the end of the interruption, preferably signalled by the user with the user's remote control device, replay is commenced from the start of the recorded section. However, the programme has to carry on being recorded and
30 replayed a certain time later in order that the user can watch the whole of the remainder

of the programme. This recording and replay mechanism for effectively time-shifting a programme to a few minutes (or whatever period) later may have to carry on throughout a contiguous viewing period.

Figure 14 is a schematic diagram of a remote control device 110. The device
 5 comprises a keyboard 700, a processor 710, a display screen 720 and a bi-directional communications interface 730, all within a housing 740 intended to be carried in the user's hand.

The bi-directional communications interface 730 is arranged to communicate data wirelessly with the remote control interface 210 of the STB 100. Since there may
 10 be many remote controls 110 operating with the system, the communication between the remote controls and the STB may operate on different respective carrier frequencies (for radio or infra-red communication) or by some other multiplexing scheme such as time division or code division multiplexing.

The keyboard accepts user input including, amongst other things, login and
 15 logout information so that a user can log in to the overall system (this information being transmitted directly to the STB 100), programme selections when that user has control of the operation of the system, device controls, for example to start a video replay from the storage device 70, and so on. Apart from the login/logout, these are generally standard functions of a remote controller.

20 Another technique for logging in to the system might just be to operate any key on the remote control 110. If each user has an individual remote control, and signals from the individual remote controls are distinguishable by the multiplexing scheme used, the simple operation of the remote control would signify the presence of that user. A further technique is for the remote control or the STB to include a microphone
 25 and voice recognition software for identifying the user.

The screen 720, for example a colour LCD screen of the general type found in palmtop computers, can display information originating from the remote control or from the STB. As examples of information originating from the remote control, when a device instruction key is operated by the user, there might be various options relating
 30 to that device operation - for example, the speed to be used in a shuttle replay

operation. These options can be presented to the user in the form of a menu or an adjustable screen icon generated by the processor 710, so that the user can select the required option to be transmitted to the STB.

5 The possibilities for display of information originating from the STB, or from the home entertainment system in general, are very large. Some examples will now be described.

(i) Personal Content

10 A user appointment diary and address/telephone book can be maintained on the data storage device 80. The user can therefore access this type of data for display on the screen 720 by communication with the STB. The way in which the data is stored and displayed can be otherwise conventional, the difference being that the storage is performed centrally rather than locally at the remote control.

(ii) Internet browsing

15 The user can browse the internet as though the remote control was a terminal directly connected via a modem link to an internet point of presence. Again, the browsing techniques can be otherwise conventional, but the modem and the software can be held centrally and operated under the control of the STB, with the remotely linked remote control being a wireless terminal.

(iii) Programme Guides

20 The user can request display on the screen 720 of a programme guide - perhaps the full EPG, the adaptive programme guide described earlier or the virtual channel also described earlier. These can be transmitted to the remote control from the STB via the communications link. The user can then page up and down the programme guide and select one or more programmes for reception and/or recording. The details
25 of the selected programmes are then retransmitted back to the STB and the requests actioned.

(iv) Related Content

The user, while watching or listening to a particular broadcast or recorded programme, can request so-called related content to be displayed on the screen 720.
30 Related content might include teletext information, subtitling, internet or recorded

material derived in the same way as described above for the "gap filling" process, and so on. In this way, the user can view related material on the screen 720 without disrupting viewing on the main screen 30 for other users.

The process for requesting related content is illustrated schematically in Figure 15. Figure 15 is a schematic flow chart divided into two columns. On the left-hand column operations by the "fixed" system, in particular by the STB 100 and the television 30, are illustrated. On the right hand column are illustrated operations carried out by the remote control 110.

A step 800 represents the viewing of a programme on the screen 30. As represented by the line 810, the viewing on the main screen 30 continues uninterrupted by the remainder of the processing to be described.

At a step 820 the user requests additional content by pressing an appropriate key or selecting from an appropriate menu on the remote control 110. This is at this stage a non-specific request. The remote control 110 does not have any local record of what additional content might be available, so the request is to provide the user with information as to what additional content might be available.

At a step 830 the STB initiates a check of what relevant additional content is available. This is carried out using the processes described above, whereby terms derived from the EPG entry relating to the currently viewed programme are used as search terms to search the internet, other programmes in the EPG, lists of pre-recorded material and so on. At a step 840 a list of available material is prepared and transmitted to the remote control 110. If the list has a large number of entries, the most likely n entries, where n is a suitable number to be displayed clearly on the screen 720, can be transmitted.

At a step 850 the user selects one item from the list of available material, and the selection is sent to the STB. At a step 860 the STB initiates retrieval and sending of the selected material to the remote control 110, and finally at a step 870 the requested material is displayed on the screen 720 and the process ends.

(v) Replays

Figure 16 schematically illustrates a similar process whereby the user can request and view on the screen 720 a replay of, for example, the last few seconds of material viewed on the main screen 30, without disrupting further viewing on the main screen 30. This can be useful, for example, in sports matches where one user might
 5 wish to see a replay of a goal being scored.

Again, Figure 16 is divided into the same two columns, and again it starts with a step 900 representing viewing of the main programme, which continues uninterrupted throughout the process of Figure 16.

At the same time as the programme is being viewed, the STB controls the
 10 temporary storage of a most recent y seconds - for example 60 seconds - of the programme to a multisession recording device such as the data storage device 80. So, at any time, the device 80 holds at least (see below) the most recent 60 seconds of viewed material.

At a step 910 the user requests a replay by pressing an appropriate button on
 15 the keyboard of the remote control. (This could be done by a menu entry but since the user may suddenly wish to do this, it is preferable to have a one-key entry for this function).

At a step 920 the STB locks (temporarily prevents deletion of) the currently held buffer file of the 60 seconds preceding the issue of the replay command and
 20 continues the recording of a further most recent 60 seconds of material. The newly recorded material is needed in case another user issues a replay command separate to the one already being processed.

At a step 930 the replay material is retrieved from the storage device and sent to the remote control for display 940 on the display screen 720. Initially, a
 25 predetermined part of the recorded y seconds of material can be displayed - for example, the earliest part, but since the user will be interested in a particular part of the material, the user is given the opportunity at a step 950 to shuttle backwards or forwards through the buffered material to search for and view the required section. In this step, certain buttons on the keyboard 700 (for example, backwards and forwards
 30 arrow keys) can be arranged to cause transmission to the STB of forward and

backward shuttle commands, affecting the current replay position within the buffered material.

Steps 930, 940 and 950 continue as a loop until the user has seen all that he requires of the replay material. When the user issues a "stop" command, for example
5 by another key of the keyboard 700, the process ends 960 and display ceases on the display screen 720. In response to this, at a step 970 the STB can now unlock and delete the y seconds of material used for the just-finished replay process.

CLAIMS

1. Apparatus for recording broadcast material, the apparatus comprising:
a buffer signal store for concurrently storing received broadcast material and
replaying the received broadcast material for display, so as to impose a time delay
5 between reception and display of the received material; and
a user-operable control for adjusting the time delay imposed by the buffer
signal store.
2. Apparatus according to claim 1, in which the buffer signal store is a hard disc
10 storage device.
3. Apparatus according to claim 1 or claim 2, comprising:
means for detecting an interruption in a user's viewing of a current received
programme;
15 means for initiating operation of the buffer signal store to store the received
programme during the interruption;
means operable by the user after the interruption to initiate replay of the signal
stored in the buffer signal store.
- 20 4. Apparatus according to claim 3, in which the detecting means comprises means
for detecting an incoming telephone call during viewing of the current programme.
5. Apparatus according to claim 3, in which the detecting means comprises means
for detecting operation of a user's doorbell during viewing of the current programme.
25
6. Apparatus for recording broadcast material, the apparatus being substantially as
hereinbefore described with reference to the accompanying drawings.
7. A method of recording broadcast material, the method being substantially as
30 hereinbefore described with reference to the accompanying drawings.



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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.Q): H4F (FAAN, FAAX, FKA, FKX)

Int CI (Ed.6): G11B 27/00; H04N (5/00, 5/775, 5/937, 9/877)

Other: Online databases: WPI, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	US 5706388 (RICOH) See whole doc. NB col.3, paras. 2 and 3; col.4, para.1.	1,2,3,4,5
X	US 5701383 (GEMSTAR) See whole doc.	1,2
X	US 5371551 (LOGAN) See whole doc.	1,2

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
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A Document indicating technological background and/or state of the art.
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E Patent document published on or after, but with priority date earlier than, the filing date of this application.